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FACT SHEET

L-742

Crop Fertilization on Texas High Plains Soils

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The High Plains of Texas is an isolated broad piedmont apron shown in figure 1. Soils vary in surface texture from loamy sands in the southwest to clay loams and silty clay loams in the northeast. The High Plains region encompasses about 19 million acres. About 7.8 million acres are in cropland of which approximately 5.3 million are irrigated. The irrigated cropland includes an estimated 82,500 acres of improved pasture.

Soil Characteristics

The High Plains soils vary greatly, not only in morphological characteristics but in native fertility and potential productive capacity. However, all are similar in that they have developed under a grass vegetation in sub-humid climate.

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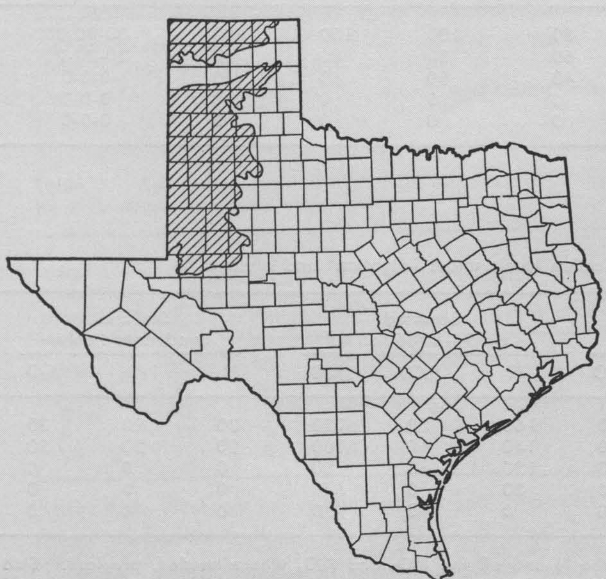

Figure 1. Location of High Plains region.

As a result of limited precipitation, very little lime has leached from these soils. A zone of lime accumulation (calcium carbonate) has developed at depths of 2½ to 5 feet. pH values above 7 generally prevail.

Mineral deposits from which the soils developed were high in potassium. Therefore, soils contain relatively high amounts of exchangeable potassium even under extended periods of cultivation.

Wind erosion is a problem, especially in the sandier regions. Wind can remove substantial amounts of topsoil and alter the productive capacity of the soil if control measures are not taken. Hardpans occur occasionally where the soils are irrigated and have not been deep-plowed for several years. For these reasons, soil management practices to improve the physical condition of these soils is highly important in crop production on the High Plains.

Soil Fertility Status

Because of soil characteristics, past fertilization and cropping practices, fertility levels vary widely for High Plains soils. This is illustrated by the soil test summary data in Table 1.

The response and return from applied nutrients is dependent on the level of the available nutrient in the soil. Information in the soil nutrient levels indicates probable responses primarily from nitrogen, (estimated from organic matter content and other information) and phosphorus and, to a lesser degree, from potassium. Such general information is useful to county agents, fertilizer industry personnel and others but does not provide specific information to the individual producer concerning fertilization of his soil. To determine nutrient levels for individual fields, representative soil samples should be tested every 2 to 3 years for soils used intensively.

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Table 1. Percentage distribution of High Plains soils in five ranges for pH, organic matter, phosphorus and potassium

Soil test level*	Percentage of samples at each level: Organic matter	Phos-phorus	Potas-sium	Soil pH range	Per-cent
VL	28	36	0	Below 6.6	1
L	64	22	0	6.6 - 7.3	9
M	8	18	1	7.4 - 7.8	35
H	0	19	4	7.9 - 8.3	50
VH	0	5	95	8.4 - 9.7	5

*Soil test summary data from Texas Agricultural Extension Service Soil Testing Laboratories.

N, P_2O_5 and K_2O for Major Crops

Although High Plains soils are relatively high in native fertility compared with other areas, the concept that nitrogen is the only element needed for sustained high production is not valid, especially under irrigation.

Nitrogen is generally the first nutrient to become deficient. This is the element required in the largest amount for field crops other than legumes. Phosphorus is the second fertilizer nutrient limiting production and potassium, third.

Because of the range in nutrient levels, soil tests are the best means of determining the present level of available nutrients and amounts of plant nutrients to apply. The expected yield is influenced by numerous management and cultural practices as well as climatic conditions. Tables 2-8 present the amounts of N, P_2O_5 and K_2O suggested under varying nutrient levels (shown by soil tests) and for varying expected yields.

Many additional factors are considered in arriving at fertilizer use suggestions shown on the soil test report. If information on a soil test report differs from these general guides, an error is not necessarily indicated. Refer questions to county agricultural agents or the Soil Testing Laboratory.

To use these tables, determine the soil test level for the nutrient in the left column and read across to the expected yield column for the rate of nutrient. For example, using Table 2, a soil with a low (L) level of nitrogen, a low (L) level of phosphorus and a very high (VH) level of potassium would show a 60-60-0 per acre for an expected yield of two bales of cotton.

Calcium, Magnesium and Sulfur

High Plains soils are generally high in calcium and magnesium; thus, deficiencies have not been reported. These two elements predominate on the clay fractions and are responsible for the alkaline condition (up to pH 8.3) of most soils. Higher pH values are generally caused by sodium accumulations. Sulfur, the third secondary element, also occurs in irrigation water in sulfate form. Some

Table 2. Application rates of nutrients for cotton—three production levels under irrigation and one for dryland

Soil test level*	Expected yield—1 ½ bale/A.			Expected yield—2 bale/A.			Expected yield—2 ½ bale/A.			Dryland (sandy lands only)
	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O	
VL	60	60	60	80	80	80	100	100	80	30-30-30
L	40	40	40	60	60	60	80	80	60	20-20-20
M	20	20	20	40	40	40	60	60	40	0-0-0
H	0	0	0	0	0	0	0	0	0	0-0-0
VH	0	0	0	0	0	0	0	0	0	0-0-0

*Texas A&M University soil testing methods and calibrations.

Table 3. Application rates of nutrients for grain sorghum—three production levels under irrigation[1] and dryland

Soil test level[2]	Expected yield—4000 lb./A.			Expected yield—6000 lb./A.			Expected yield—8000 lb./A.[3]			Dryland (Sandy lands only)		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
VL	80	40	80	120	60	100	160	80	120	30	20	20
L	60	40	60	100	40	80	140	60	100	20	20	20
M	40	0	0	80	20	60	120	40	80	0	0	0
H	0	0	0	40	0	40	80	0	40	0	0	0
VH	0	0	0	0	0	0	0	0	0	0	0	0

[1]For sandy soils and others that take water rapidly, apply about half the N and all the P_2O_5 and K_2O, where needed, preplant. Sidedress remainder of N within 35 days after crop is up being careful to avoid root pruning.

[2]Texas A&M University soil testing methods and calibrations.

[3]For expected yields in excess of 8,000 pounds, increase the N rate by 20 pounds of N for each 1,000 pounds.

Table 4. Application rates of nutrients for corn—two production levels

Soil test level*	Expected yield—100 bu./A.			Expected yield—150 bu./A.		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O
VL	120	80	120	180	80	140
L	100	60	100	140	60	120
M	80	40	80	100	40	100
H	40	0	40	60	0	60
VH	0	0	0	0	0	0

*Texas A&M University soil testing methods and calibrations.

fertilizers are formulated with various sulfur materials. For these reasons, a general need for sulfur as a plant nutrient has not been shown and is not anticipated. The extent to which this element will give yield responses is under study.

Micronutrients

Because numerous soil conditions affect the availability of micronutrients and differences in crop requirement, no general need for additions of

Table 5. Application rates of nutrients for alfalfa maintenance—three production levels

Soil test levels[1]	Expected yield—4 ton/A.			Expected yield—6 ton/A.			Expected yield—8 ton/A.		
	N[2]	P_2O_5	K_2O	N[2]	P_2O_5	K_2O	N[2]	P_2O_5	K_2O
VL	0	60	120	0	100	160	0	140	200
L	0	40	80	0	80	120	0	120	160
M	0	40	40	0	60	80	0	100	120
H	0	0	0	0	40	40	0	80	80
VH	0	0	0	0	0	0	0	40	40

[1]Texas A&M University soil testing methods and calibrations.

[2]Include 20-30 pounds of N per acre for new plantings.

TABLE 6. Application rates of nutrients for wheat—three production levels with moderate grazing[1]

Soil test level[2]	Expected yield—40 bu./A.			Expected yield—60 bu./A.			Expected yield—80 bu./A.			Dryland (Sandy lands only)		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
VL	80	40	40	120	50	50	140	60	60	30	20	20
L	60	20	20	100	40	40	120	50	50	20	0	0
M	40	0	0	60	30	30	100	40	40	0	0	0
H	0	0	0	40	0	0	60	0	0	0	0	0
VH	0	0	0	0	0	0	0	0	0	0	0	0

[1]For sands apply all the P_2O_5 and K_2O and part of the N preplant. Topdress remainder of N ahead of joint stage. For clays, all the fertilizer may be applied before planting.

[2]Texas A&M Universtiy soil testing methods and calibrations.

Table 7. Application rates of nutrients for established hybrid bermudagrass—two production levels.

Soil test level[1]	Expected yield—4 ton/A.			Expected yield—8 ton/A.		
	N[2]	P_2O_5	K_2O	N[2]	P_2O_5	K_2O
VL	120	80	100	300	100	200
L	100	60	80	180	80	160
M	60	0	40	140	60	120
H	0	0	0	80	0	60
VH	0	0	0	0	0	0

[1]Texas A&M Universtiy soil testing methods and calibrations.

[2]Apply 60-80 pounds N, all the P_2O_5 and half the K_2O where K_2O rates are heavier than 80 pounds in the spring ahead of irrigation. Apply remainder of nitrogen in 50-70 pound increments after each time grazed down or cut. Remove cattle before fertilizing and defer grazing for at last a week after irrigation is complete.

Table 8. Application rates of nutrients for forage sorghums and sudan—sorghum types—two irrigated production levels.

Soil test level[1]	Medium production			High production		
	N[2]	P_2O_5	K_2O	N[2]	P_2O_5	K_2O
VL	80	40	40	140	80	80
L	60	30	30	100	60	60
M	40	0	0	60	40	40
H	0	0	0	30	0	0
VH	0	0	0	0	0	0

[1]Texas A&M University soil testing methods and calibrations.

[2]Should be divided into 40-60 pound applications with one application preplant and an additional similar application after each time cut or grazed down and just ahead of irrigation.

micronutrients is indicated. Of the seven elements in this group, only iron and zinc presently are considered important. Iron deficiency, as characterized by yellowing between the veins of sorghum, is common on high-lime soils. Zinc deficiency has been observed on cotton in isolated areas high in lime, in areas that have received applications of phosphate sufficient to produce very high levels and in cut areas where topsoil has been removed.

Soil test values for pH, calcium and phosphorus give some indication as to the probability of deficiencies of iron and zinc; however, past history and close observation for deficiency symptoms in the field offer the best guide. Research studies are underway with these and other micronutrients. See Extension leaflets, L-721 and L-723, available from your county agricultural agent, for a more complete discussion about zinc and iron.

Conversion Factors

The phosphorus and potassium contents of fertilizers are guaranteed as percent P_2O_5 and K_2O. Soil test values are also reported in these terms. However, plant analyses results usually are reported as percentages of the element. For this reason, the following factors are presented for use in converting from one form to the other.

From P_2O_5	to P	multiply by 0.44
From P	to P_2O_5	multiply by 2.29
From K_2O	to K	multiply by 0.83
From K	to K_2O	multiply by 1.20

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